

Exhibit 2

Preliminary Claim Chart

US7046252B2

VS

Renesas TW2864

US7046252B2	Renesas TW2864
<p>1. <u>A method for adaptive color contrast of an image displayed on a display device</u>, comprising:</p>	<p>Analyst Comment: TW 2864 (i.e., display device) adjusts the brightness and contrast of the picture and adopts image enhancement techniques (i.e., adaptive color contrast).</p> <p>.....</p> <p><u>The TW2864 adjusts brightness by adding a programmable value (in register BRIGHTNESS) to the Y signal. It adjusts the picture contrast by changing the gain (in register CONTRAST) of the Y signal.</u></p> <p>The TW2864 is Techwells 4th generation 4-in-1 video decoder and audio codec for security surveillance applications. The device <u>includes four high quality NTSC/PAL video decoders</u> that convert analog composite video signal to digital component YCbCr data. The TW2864 contains four 10-bit ADCs and proprietary clamp and gain controllers and <u>utilizes adaptive 4H comb filter for separating luminance & chrominance to reduce cross noise artifacts</u>. The TW2864 adopts <u>the image enhancement techniques</u> such as IF compensation filter, CTI and programmable peaking. The TW2864 also includes audio codec which has four audio ADCs and one audio DAC. A built-in audio controller can generate digital outputs for recording/mixing and <u>accepts digital input for playback</u>. Source: https://www.renesas.com/us/en/products/analog</p>
<p><u>separating input data into luma and chroma components;</u></p>	<p>Analyst Comment: The composite video signal (i.e., input data) is separated into luma (Y) (i.e., brightness of the image) and chroma (C) (i.e., color information) by TW2864.</p> <p>.....</p> <p><u>The color-decoding block contains the luma/chroma separation for the composite video signal and multi-standard color demodulation. For NTSC and PAL standard signals, the luma/chroma separation can be done either by comb filter or notch/band-pass filter combination. For SECAM standard signals, adaptive notch/band-pass filter is used. The default selection for NTSC/PAL is comb filter.</u></p> <p>In the case of comb filter, <u>the TW2864 separates luma (Y) and chroma (C) of a NTSC/PAL composite video signal using a proprietary 4H adaptive comb filter. The filter uses a four-line buffer. Adaptive logic combines the upper-comb</u> Source: https://www.renesas.com/us/en/document/dst/tw2864-datasheet</p>
<p><u>collecting luma distribution data;</u></p>	<p>Analyst Comment: This element is infringed literally, or in the</p>

analyzing the luma distribution data;
generating appropriate contrast control
response based upon the analyzed
luma distribution data;

alternative, under the doctrine of equivalents.

The information about the brightness and contrast (i.e., luma distribution data) of the video signal is collected and analyzed by TW2864 through luminance processing. Based upon the analyzed information of brightness and contrast (i.e., analyzing luma distribution data) of the video signal the brightness and contrast of the picture are adjusted accordingly (i.e., contrast control response). TW2864 has a brightness control register for controlling brightness and contrast control register for controlling the contrast of the video.

Luminance Processing

The TW2864 adjusts brightness by adding a programmable value (in register BRIGHTNESS) to the Y signal. It adjusts the picture contrast by changing the gain (in register CONTRAST) of the Y signal.

0X01(CH1)/0X11(CH2)/0X21(CH3)/0X31(CH4) – BRIGHTNESS CONTROL REGISTER

BIT	FUNCTION	R/W	DESCRIPTION	RESET
7-0	BRIGHT	R/W	These bits control the brightness. They have value of –128 to 127 in 2's complement form. Positive value increases brightness. A value 0 has no effect on the data.	00

0X02(CH1)/0X12(CH2)/0X22(CH3)/0X32(CH4) – CONTRAST CONTROL REGISTER

BIT	FUNCTION	R/W	DESCRIPTION	RESET
7-0	CNTRST	R/W	These bits control the luminance contrast gain. A value of 100 (64h) has a gain of 1. The range of adjustment is from 0% to 255% at 1% per step.	5C

Source: <https://www.renesas.com/us/en/document/dst/tw2864-datasheet>

modifying the incoming luma
component based upon the contrast
control response;

Analyst Comment: This element is infringed literally, or in the alternative, under the doctrine of equivalents. The brightness of the composite video signal (i.e., incoming luma component) is adjusted by TW2864.

Luminance Processing

The TW2864 adjusts brightness by adding a programmable value (in register BRIGHTNESS) to the Y signal. It adjusts the picture contrast by changing the gain (in register CONTRAST) of the Y signal.

	<p>The color-decoding block contains the luma/chroma separation for the composite video signal and multi-standard color demodulation. For NTSC and PAL standard signals, <u>the luma/chroma separation can be done either by comb filter or notch/band-pass filter combination</u>. For SECAM standard signals, adaptive notch/band-pass filter is used. The default selection for NTSC/PAL is comb filter.</p> <p>Source: https://www.renesas.com/us/en/document/dst/tw2864-datasheet</p>
<p><u>analyzing the modified luma component; and generating a non-linear chroma correction factor based upon the analyzed modified luma component.</u></p>	<p>Analyst Comment: This element is infringed literally, or in the alternative, under the doctrine of equivalents. The adjusted brightness of the composite video signal (i.e., modified luma component) is analyzed and based upon the adjusted brightness of the composite signal, the hue and saturation of the video signal can be adjusted independently (i.e., generating a non-linear chroma correction factor) according to adjusted brightness (i.e., modified luma component).</p> <p>=====</p> <p>Luminance Processing</p> <p>The TW2864 adjusts brightness by adding a programmable value (in register BRIGHTNESS) to the Y signal. <u>It adjusts the picture contrast by changing the gain (in register CONTRAST) of the Y signal.</u></p> <p>The color-decoding block contains the luma/chroma separation for the composite video signal and multi-standard color demodulation. For NTSC and PAL standard signals, <u>the luma/chroma separation can be done either by comb filter or notch/band-pass filter combination</u>. For SECAM standard signals, adaptive notch/band-pass filter is used. The default selection for NTSC/PAL is comb filter.</p> <p>The Automatic Chroma Gain Control (ACC) compensates for reduced amplitudes caused by high-frequency loss in video signal. <u>In the NTSC/PAL standard, the color reference signal is the burst on the back porch. It is measured to control the chroma output gain.</u> The range of ACC control is -6db to +24db.</p> <p>CHROMINANCE GAIN, OFFSET AND HUE ADJUSTMENT</p> <p>When decoding NTSC signals, TW2864 can adjust the hue of the chroma signal. <u>The hue is defined as a phase shift of the subcarrier with respect to the burst.</u> This phase shift of NTSC decoding can be programmed through a control register. For the PAL standard, the PAL delay line is provided to compensate any hue error; therefore, there is no hue adjustment available. The color saturation can be adjusted by <u>changing the gain of Cb and Cr signals</u> for all NTSC, PAL and SECAM formats. <u>The Cb and Cr gain can be adjusted independently for flexibility.</u></p>

0X04(CH1)/0X14(CH2)/0X24(CH3)/0X34(CH4) – CHROMA (U) GAIN REGISTER				
BIT	FUNCTION	R/W	DESCRIPTION	RESET
7-0	SAT_U	R/W	These bits control the digital gain adjustment to the U (or Cb) component of the digital video signal. The color saturation can be adjusted by adjusting the U and V color gain components by the same amount in the normal situation. The U and V can also be adjusted independently to provide greater flexibility. The range of adjustment is 0 to 200%. A value of 128 (80h) has gain of 100%.	80
Source: https://www.renesas.com/us/en/document/dst/tw2864-datasheet				